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MILITARY POTENTIAL TEST OF THE PORTABLE LUBRICATION UNIT (BATTE--ETC(U)
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USATECOM PROJECT NO. 7-4-0446-01

REPORT OF TEST OF

"MILITARY POTENTIAL TEST OF THE
PORTABLE LUBRICATION UNIT (BATTERY POWERED)"

DA PROJECT NO. UNKNOWN

FINAL REPORT OF TEST

AUTHOR: James C. Key

6 July 1965

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AVIATION TEST BOARD

FORT RUCKER, ALABAMA

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6 MILITARY POTENTIAL TEST OF THE
PORTABLE LUBRICATION UNIT (BATTERY POWERED)

DA PROJECT NO. UNKNOWN

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AUTHOR: James C. Key

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9 FINAL REPORT, 26 Oct 64-

4 May 65

UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36362

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~~FOR OFFICIAL USE ONLY~~ABSTRACT

↓ The US Army Aviation Test Board conducted the Military Potential Test of the Portable Lubrication Unit at Fort Rucker, Alabama, from 26 October 1964 to 4 May 1965 to determine physical, operational, ground-handling, and air-transportability characteristics; functional suitability and compatibility; reliability; and personnel requirements. The unit was comparatively evaluated against the present standard portable lubricator. The physical characteristics, with the exception of the servicing hose, and the operation of the test item were satisfactory. The test item was difficult to move over soft dirt and sod because of insufficient ground clearance and flotation. The lubricator could be air-transported internally in UH-1(), UH-19, CH-21, CH-34, CH-37, CH-47, CV-2, U-6, and U-1A Aircraft, but it did not have attachments for external (sling) loading. The test item was reliable during the test. The significant differences in the test item and the currently-authorized lubricator were: (1) The test item was 31 pounds lighter and did not require a pre-charge from an external air pressure source each time the grease container was refilled. (2) The service hose on the test item was 10 feet shorter than the one on the currently-authorized unit. Specialized training of personnel was not required. It is recommended that, after correction of deficiencies, the test item be considered a suitable substitute for the currently-authorized portable lubricator, and that the shortcomings be corrected as practical.

↙

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Letter, SMOSM-EH/J7111, Headquarters, US Army Aviation and Surface Materiel Command, 13 February 1964, subject: "Portable Lubricating Unit, Request for Test Plan," with first indorsement, Headquarters, US Army Test and Evaluation Command, 26 February 1964.

2. REFERENCES.

- a. Military Specification, MIL-L-7312B, 15 December 1958.
- b. Technical Manual, T.O. 34Y17-4-14-1, "Lubricating Unit," 1 July 1961.
- c. Technical Manual, T.O. 34Y17-4-14-4, "Lubricating Unit," 1 July 1961.
- d. Military Specification, MIL-L-43131 (GL), 18 February 1963.
- e. USATECOM Regulation 705-2, 25 September 1963.
- f. USATECOM Regulation 705-5, 23 December 1963.
- g. Letter, AMSTE-BG, Headquarters, US Army Test and Evaluation Command, 26 April 1965, subject: "Plan of Test for Military Potential Test of a Portable Lubrication Unit (Battery Powered), USATECOM Project No. 7-4-0446-01."

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DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36362

"MILITARY POTENTIAL TEST OF THE
PORTABLE LUBRICATION UNIT (BATTERY POWERED)"

USATECOM PROJECT NO. 7-4-0446-01

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SECTION 1 - GENERAL

1.1. TEST OBJECTIVES.

1.1.1. Purpose.

To determine the military potential of the portable lubricating unit, and conduct a comparative evaluation with the present standard portable lubricator (FSN 4930-806-7970).

1.1.2. Objectives.

1.1.2.1. To determine:

- a. Physical characteristics
- b. Operational capabilities
- c. Functional suitability and compatibility
- d. Ground-handling characteristics
- e. Air-transportability characteristics
- f. Reliability
- g. Personnel requirements

1.1.2.2. To conduct a comparative evaluation with the current standard portable lubricator (FSN 4930-806-7970).

1.2. DESCRIPTION OF MATERIEL.

The portable lubrication unit (figures 1 and 2) is electrically (battery) powered and is designed to dispense light- or heavy-bodied lubricants to lubricate grease fittings on aircraft, automotive vehicles, and similar equipment. The power to operate the lubricator pump is supplied by a 24-volt d. c. aircraft-type battery. A self-contained electrical battery-charger operates on 110 volts a. c. and has automatic cut-off features. The dispensing-hose assembly is 15 feet long. Two nozzles are provided: one is adjustable from 1,000 to 6,000 p. s. i. , and the other, from 6,000 to 11,000 p. s. i. These nozzles permit control of operating

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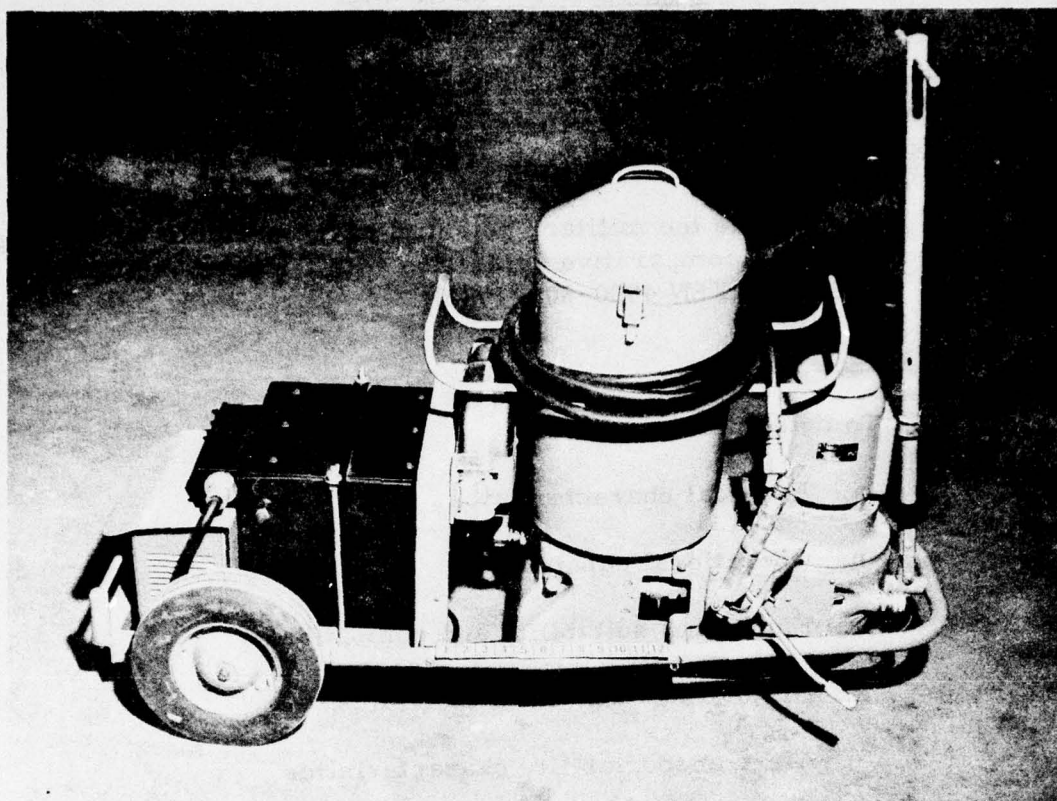


Figure 1. The test portable lubrication unit.

pressure between 1,000 to 11,000 p.s.i. The complete lubricator assembly is mounted on a three-wheeled chassis with guard rails and a steerable towing handle (figure 3).

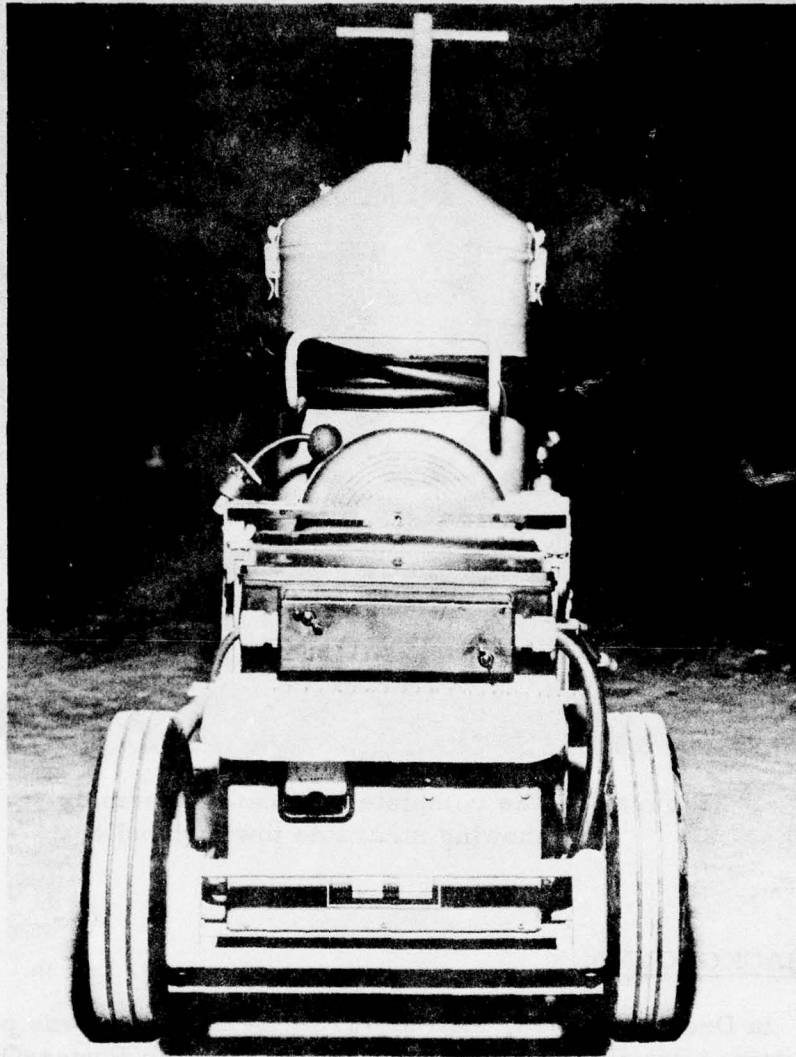


Figure 2. Rear view of the
test portable lubrication unit.

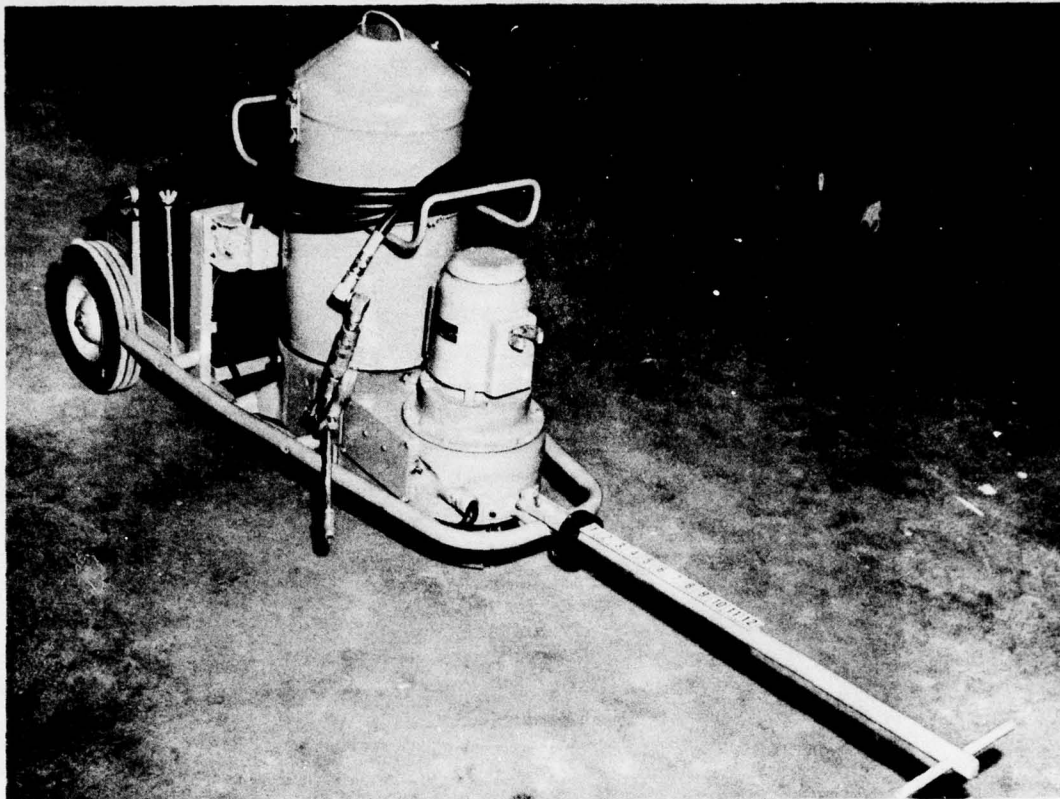


Figure 3. The complete lubricator assembly showing steerable towing handle.

1.3. BACKGROUND.

1.3.1. In December 1958, MIL-L-7312B (reference a) was published and contained detailed specifications for an Electric Power-Operated Portable Lubricating Unit. This specification was based on the premise that electrical power would be available at the user level. Since this design was not compatible with many field-operating situations, a new Military Specification (MIL-L-34141 (GL)) was published in February 1963 (reference d). The primary change that this specification stipulated was that the lubricator be battery powered. A lubricator, based on this new specification, is currently in the system and is catalogued as FSN 4930-806-7970.

1.3.2. The test item is a manufacturer's unsolicited product-improvement item and was received on 22 October 1964.

1.4. FINDINGS.

1.4.1. The physical characteristics of the test item were satisfactory with the exception of the servicing hose which was too short for servicing the YCH-54A.

1.4.2. The operation of the test item was satisfactory.

1.4.3. The minimum pressure (1000 p.s.i.) was excessive for servicing Army aircraft components incorporating grease seals. The pressure was adequate for servicing Army aircraft ground-support equipment.

1.4.4. The test item was difficult to move over soft dirt and sod because of insufficient ground clearance and flotation.

1.4.5. The lubricator could be air transported internally in aircraft listed in paragraph 2.5.3.2. It did not have attachments for external (sling) loading.

1.4.6. The test item was reliable during the test.

1.4.7. Specialized training of personnel for proper use of the test item was not required. Publications for operation and maintenance were not furnished.

1.4.8. The deficiency and the shortcomings discovered during the test are listed in appendix I.

1.4.9. The test item was compared with the currently-authorized lubricator (FSN 4930-806-7970). The significant differences in the two items were:

1.4.9.1. The self-contained test item was 31 pounds lighter and did not require a pre-charge from an external air pressure source each time the grease container was refilled.

1.4.9.2. The service hose on the test item was 10 feet shorter than the one on the currently-authorized unit.

1.5. CONCLUSIONS.

- 1.5.1. The test portable lubrication unit has military potential.
- 1.5.2. The test portable lubrication unit compares favorably with the currently-authorized item and offers advantages in weight saving and simplicity of operation.
- 1.5.3. The deficiency and shortcomings listed in appendix I should be corrected.

1.6. RECOMMENDATIONS.

It is recommended that:

- 1.6.1. The test item be considered a suitable substitute for the currently-authorized portable lubricator, after correction of the deficiency.
- 1.6.2. The shortcomings listed in appendix I be corrected as practical.

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SECTION 2 - DETAILS AND RESULTS OF SUBTESTS

2.0. INTRODUCTION.

The portable lubrication unit was subjected to tests typical of normal use in an Army temperate environment. Testing was conducted at Fort Rucker, Alabama, from 26 October 1964 to 4 May 1965.

2.1. PHYSICAL CHARACTERISTICS.

2.1.1. Objective.

To determine the physical characteristics of the test item.

2.1.2. Method.

The lubricator was weighed and measured. The length of the service hose and electrical cable was measured.

2.1.3. Results.

2.1.3.1. The test item weighed 250 pounds empty, and 290 pounds with the grease container full. See figure 4.

2.1.3.2. The dimensions were:

Length	44 in.
Width	18 in.
Height	30 in.
Servicing hose	15 ft.
Electrical cable	25 ft.
Back wheels (2)	10 x 2.75 (two-ply solid rubber)
Front wheel (1)	5 x 1.75 (two-ply solid rubber)

2.1.4. Analysis.

The servicing hose was not long enough to lubricate the YCH-54A main rotor and tail-rotor assemblies. A servicing hose 30 feet long is required.

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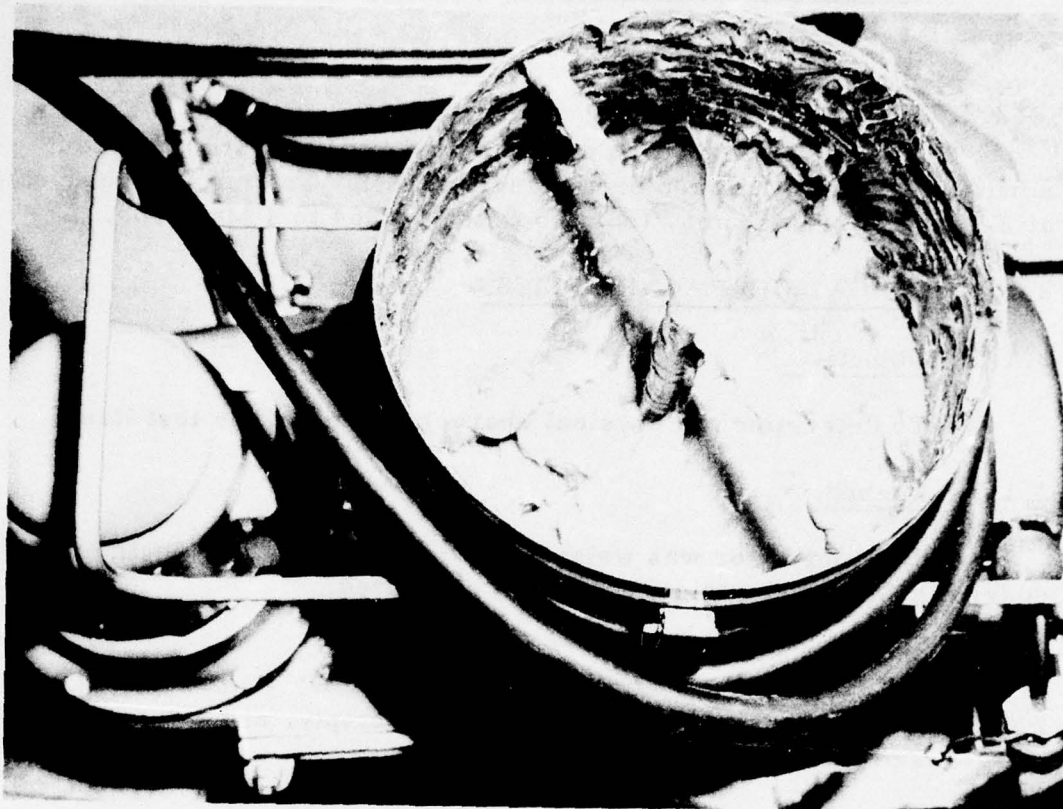


Figure 4. Grease container

2.2. OPERATIONAL CAPABILITIES.

2.2.1. Objective.

To determine the operational capabilities of the test item.

2.2.2. Method.

2.2.2.1. Flow and Pressure.

The test item was operated utilizing MIL-L-25537 grease. The pressure capacity was measured by using a pressure gauge. The

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average rate of flow was determined by weighing the amount of grease the unit dispensed in one minute.

2.2.2.2. Battery-Charging Capability.

The battery was discharged to a point where it would not satisfactorily operate the unit. The time required to recharge the battery was recorded.

2.2.2.3. Battery Performance.

2.2.2.3.1. With the battery fully charged, the test item was continuously operated to determine the time to discharge the battery completely.

2.2.2.3.2. The test item, with a fully-charged battery, was operated intermittently throughout the test period under conditions similar to that which could be expected in a field operation.

2.2.2.4. Electrical Stability.

The build-up of heat and the presence of radio/electronic interference were noted.

2.2.3. Results.

2.2.3.1. Flow and Pressure.

The rate of flow of MIL-L-25537 grease at 67°F. was 1.8 pounds per minute at 6000 p.s.i., and 1.2 pounds per minute at 1000 p.s.i. An external supply of air was not required to pre-charge the unit each time the grease container was refilled.

2.2.3.2. Battery-Charging Capability.

Ten and one-half hours were required to recharge the battery.

2.2.3.3. Battery Performance.

2.2.3.3.1. The lubricator ran continuously for 2.4 hours before the battery was discharged to the point that it would no longer satisfactorily operate the unit.

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2.2.3.3.2. The battery did not have to be recharged during the test period except for conducting test discussed in paragraph 2.2.3.3.1 above. During the servicing of Army aircraft, this test item dispensed 52 pounds of MIL-L-25537 grease.

2.2.3.4. There was no unusual build-up of heat. No aircraft radio/electronic interference was noted when the test item was operated.

2.2.4. Analysis.

An auxiliary power receptacle is desired by which the pump can be driven or battery charged, directly from an auxiliary power power unit (APU) or a vehicle. Such a capability will enhance the test item by making it compatible with two different power sources.

2.3. FUNCTIONAL SUITABILITY AND COMPATIBILITY.

2.3.1. Objective.

To determine the functional suitability and compatibility of the portable lubrication unit with present standard equipment.

2.3.2. Method.

2.3.2.1. Aircraft.

The following types were lubricated with the test item in accordance with service instructions contained in the applicable aircraft technical manual:

- a. OH-13
- b. OH-23
- c. UH-1B
- d. UH-1D
- e. CH-34
- f. CH-47
- g. YCH-54A

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h. O-1

i. U-1A

j. U-6

k. CV-2

l. OV-1

2.3.2.2. Ground-Support Equipment.

The following ground-support equipment, typical of that in aviation units, was lubricated with the test item in accordance with service instructions contained in the applicable vehicle technical manual:

<u>Nomenclature</u>	<u>Federal Stock Number</u>
a. Truck, 1/4-ton, 4 x 4, M-38	2320-835-8318
b. Multi-Purpose Unit, 3/4-ton	1730-341-1965
c. Truck, Tractor Wrecker, 5-ton, 6 x 6, M-246	2320-835-8639
d. Truck, Fork Lift, 2000 pounds	3920-273-8223
e. Truck, Fork Lift, 6000 pounds	3920-272-9290
f. Tractor, Warehouse	2930-214-1027
g. D.C. Generator Set, EAPU	6115-511-2210
h. Truck, Tank, Fuel, M-49	2320-141-8235
i. Reciprocating Power-Driven Compressor	4310-678-9645
j. Semitrailer, Low Bed, 25-ton, M-172A1	2330-317-6448

2.3.2.3. Human Factors.

The human factors and safety aspects were observed and recorded throughout the test.

2.3.3. Results.

2.3.3.1. The aircraft listed above were lubricated using the 1000-p.s.i. (minimum nozzle pressure) and 6000-p.s.i. nozzles. The test item nozzles were compatible with Army aircraft lubrication fittings. The 1000-p.s.i. pressure was excessive for lubricating components with grease seals; however, it was satisfactory for lubricating components without seals.

2.3.3.2. The YCH-54A Helicopter main-rotor assembly, which contains the zerk-type fittings without grease seals, was lubricated in 20 minutes utilizing the test item. (This time does not include the time needed to place the test item on a maintenance stand in order to reach YCH-54A main-rotor assembly.) One hour was required to perform the same functions with the standard hand lubricator.

2.3.3.3. The test item, using both the 1000- and 6000-p.s.i. nozzles, was satisfactory for lubricating the ground-support equipment and the nozzles were compatible with the lubrication fittings.

2.3.3.4. There were no unusual safety hazards or human factors problems noted.

2.3.4. Analysis.

2.3.4.1. The test item was compatible with present standard (aircraft and ground-support) equipment. However, the extension hose was too short for use with the YCH-54A without a maintenance stand.

2.3.4.2. The test item was functionally suitable except for the nozzle pressure which could not be adjusted lower than 1000 p.s.i. The test item should incorporate a nozzle with a pressure range adjustable from a minimum of 100 p.s.i. to a maximum of 6000 p.s.i.

2.4. GROUND HANDLING.

2.4.1. Objective.

To determine the ground-handling characteristics of the test item.

2.4.2. Method.

The test item was moved over the various surfaces typical of aircraft parking areas.

2.4.3. Results.

The ground clearance (3.5 inches) and tire size of the test item made movement very difficult over other than hard, flat surfaces. The test item was easily moved by one person on a hard, flat surface.

2.4.4. Analysis.

A higher ground clearance and an increase in tire size would facilitate movement over various types of surfaces.

2.5. AIR TRANSPORTABILITY.

2.5.1. Objective.

To determine the air-transportability characteristics of the test item.

2.5.2. Method.

The test item was loaded internally into various utility and cargo aircraft.

2.5.3. Results.

2.5.3.1. Three persons were required for loading the test item internally in Army aircraft. A guard rail on each side of the test item (figure 5) facilitated loading and protected the lubricator against handling damage.

2.5.3.2. The test item can be transported internally in UH-1(), UH-19, CH-21, CH-34, CH-37, CH-47, CV-2, U-6, and U-1A aircraft and standard Army vehicles and trailers. The test item did not have attaching points for sling loading.

2.5.4. Analysis.

The test item was suitable for internal air transport; however, attachment points are required for sling loading to improve the air transportability of the test item.

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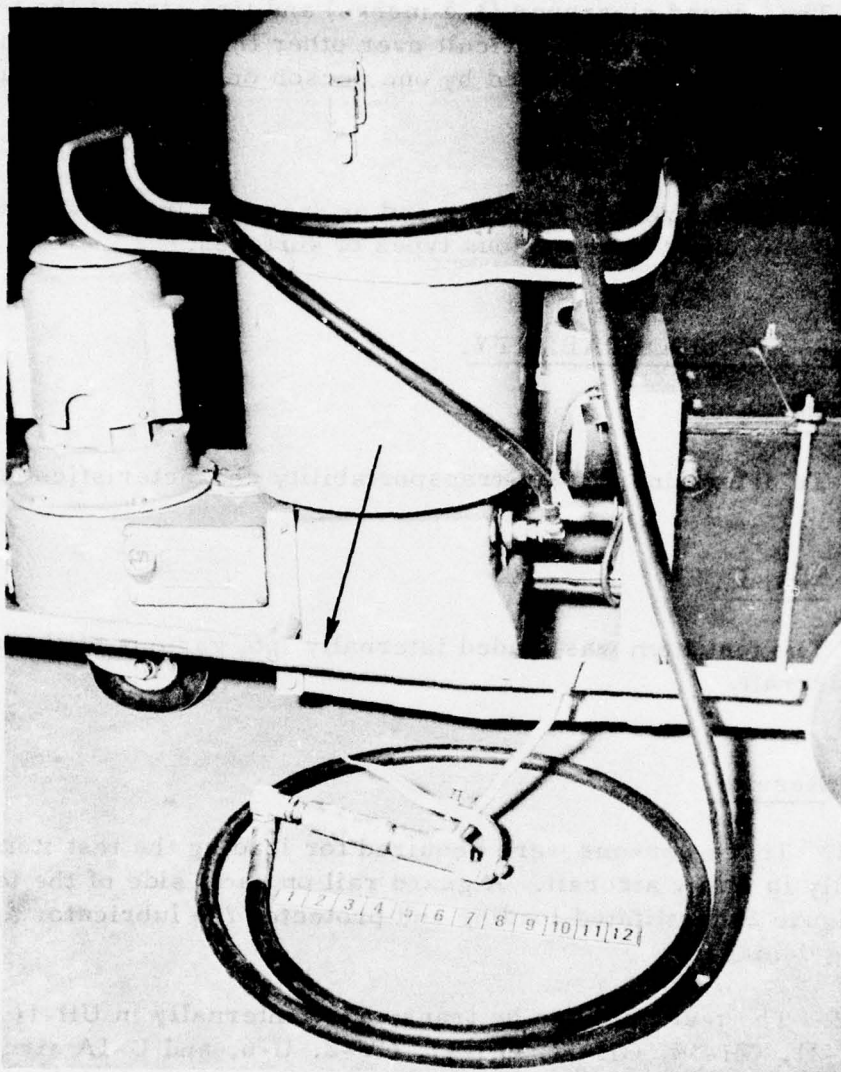


Figure 5. Guard rail provided on each side of the test lubricator

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2.6. RELIABILITY.

2.6.1. Objective.

To determine the reliability of the test item.

2.6.2. Method.

2.6.2.1. The test item was operated to simulate field use. The operating time and required replacements parts were recorded.

2.6.2.2. All scheduled and unscheduled maintenance required was recorded by category. This information was tabulated for establishing skill-level requirements for maintenance personnel.

2.6.3. Results.

2.6.3.1. The test item was operated 6.3 hours. Replacement parts were not required.

2.6.3.2. Thirty minutes were required for unscheduled maintenance to correct a malfunction of the pressure-relief switch. An inspection revealed that the switch had seized. This malfunction was corrected by actuating the switch with a common screwdriver.

2.6.3.3. A total of only 1.3 hours was required during the test period for preventive maintenance, cleaning, and lubrication. No special skill was required for operation and maintenance.

2.6.4. Analysis.

Not applicable.

2.7. PERSONNEL REQUIREMENTS.

2.7.1. Objective.

To determine personnel training requirements.

2.7.2. Method.

2.7.2.1. Training.

Army mechanics and maintenance personnel of various skill levels used the test item. This information was tabulated to establish skill levels required for maintenance personnel.

2.7.2.2. Publications. ~~FOR OFFICIAL USE ONLY~~

Except for the manufacturer's instructions for use of the nozzle, publications were not provided.

2.7.3. Results.

2.7.3.1. Army mechanics and maintenance contractor personnel of various skills satisfactorily operated the test item with minimum instructions after ten minutes of on-the-job training. No special training or skills were required for operation or maintenance.

2.7.3.2. Publications for operating the test item were not provided. The manufacturer's instructions for use of the nozzles were satisfactory. A checklist for operation was not provided on the test item.

2.7.4. Analysis.

2.7.4.1. The test item was easily operated and maintained.

2.7.4.2. Publications in the standard Army format should be provided for operation and maintenance of the test item. An operational checklist should be provided on the unit.

2.8. COMPARATIVE ANALYSIS.

2.8.1. Objective.

To conduct a comparative analysis of the test item with the currently-authorized portable lubricator, FSN 4930-806-7970.

2.8.2. Method.

The currently-authorized portable lubricator was obtained for comparative evaluation and was subjected to the same tests as the test item:

- a. Physical characteristics, paragraph 2.1.2.
- b. Operational characteristics, paragraph 2.2.2.
- c. Functional suitability and compatibility, paragraph 2.3.2.

- d. Ground-handling characteristics, paragraph 2.4.2.
- e. Air transportability, paragraph 2.5.2.
- f. Reliability, paragraph 2.6.2.
- g. Personnel requirements, paragraph 2.7.2.

2.8.3. Results.

The following tables reflect the results of the comparative test of the test item and the currently-authorized portable lubricator:

2.8.3.1. Physical Characteristics. See figures 1, 2, 3, 6, and 7.

	<u>Test Item</u>	<u>Authorized Lubricator</u>
Weight		
Empty	250 lb.	281 lb.
Serviced	290 lb.	321 lb.
Length	44 in.	42 in.
Width	18 in.	20 in.
Height	30 in.	29.5 in.
Servicing hose	15 ft.	25 ft.
Electrical cable	25 ft.	25 ft.
Tires		
Pneumatic (4)	None	410/350.7
Back solid rubber (2)	10 x 2.75	None
Front solid rubber (1)	5 x 1.75	None

2.8.3.2. Operational Characteristics.

	<u>Test Item</u>	<u>Authorized Lubricator</u>
Rate of flow per minute	1.8 lb.	1.5 lb.
Pressure		
Minimum	1000 p. s. i.	1000 p. s. i.
Maximum	6000 p. s. i.	6000 p. s. i.
Battery - charging time	10.5 hr.	11.3 hr.
Battery performance - continuous operation	2.4 hr.	2.2 hr.
Presence of heat and electronic interference	None	None
Capability of being driven or battery-charged by an APU or vehicle	No	No

2.8.3.3. Functional Suitability.

	<u>Test Item</u>	<u>Authorized Lubricator</u>
Compatibility of nozzles with Army aircraft lubrication fittings	Yes	Yes
Suitability for servicing components:		
With grease seals	No	No
Without grease seals	Yes	Yes
Capability to reach YCH- 54A main-rotor assembly grease fittings from the ground.	No	Yes
Suitability for servicing ground-support equip- ment	Yes	Yes

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2.8.3.4. Ground Handling.

	<u>Test Item</u>	<u>Authorized Lubricator</u>
Ease of handling on soft dirt, sod, and uneven terrain	No	No
Ease of movement by one man over hard, even surface	Yes	Yes

2.8.3.5. Air Transportability.

	<u>Test Item</u>	<u>Authorized Lubricator</u>
Suitability for internal loading in Army aircraft and vehicles (paragraph 2.3.2.)	Yes	Yes
Personnel required to load the lubricator	3	3
Attachment points for sling loading	No	No

2.8.3.6. Reliability.

	<u>Test Item</u>	<u>Authorized Lubricator</u>
Total hours of operation during test	6.3 hr.	3.8 hr.
Replacement parts required	None	None
Scheduled maintenance	1.3 hr.	1.5 hr.
Unscheduled maintenance	0.5 hr.	None
Special training or skill required	None	None
On-the-job training required	10 minutes	20 minutes

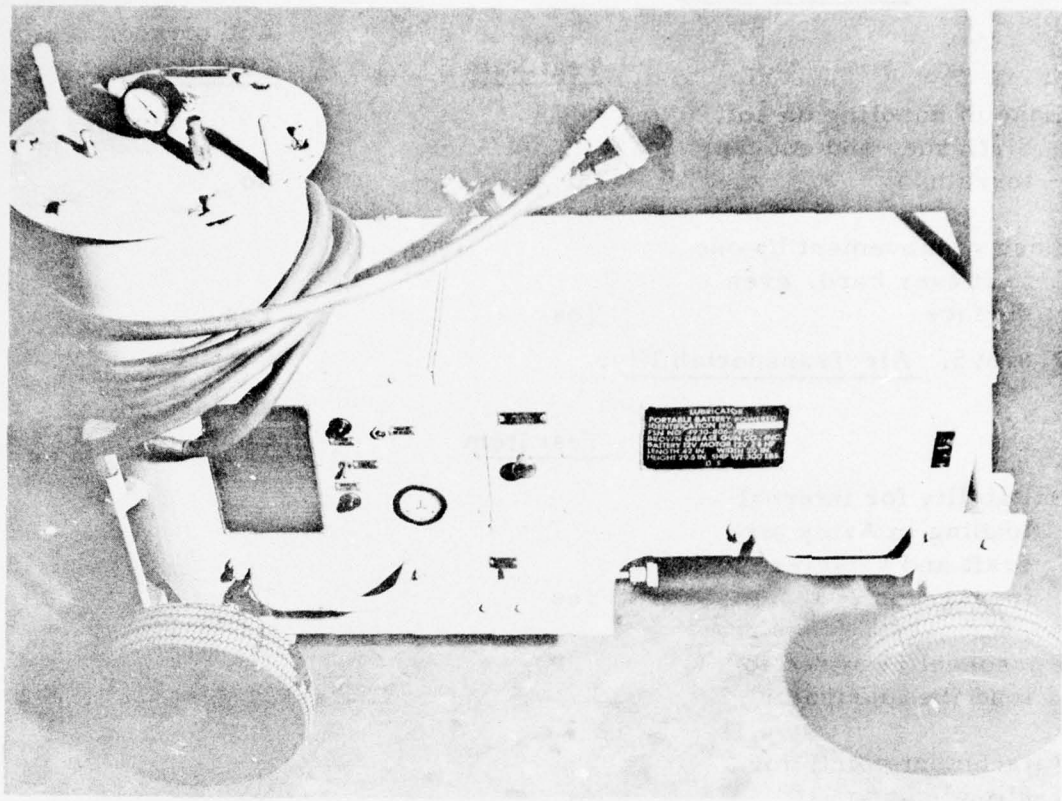


Figure 6. Side view of the currently-authorized unit

2.8.4. Analysis.

The significant differences in the two items were:

- a. The test item was 31 pounds lighter and did not require a pre-charge from external air pressure source each time the grease container was refilled.
- b. The service hose on the currently-authorized unit was 10 feet longer than the one on the test item.

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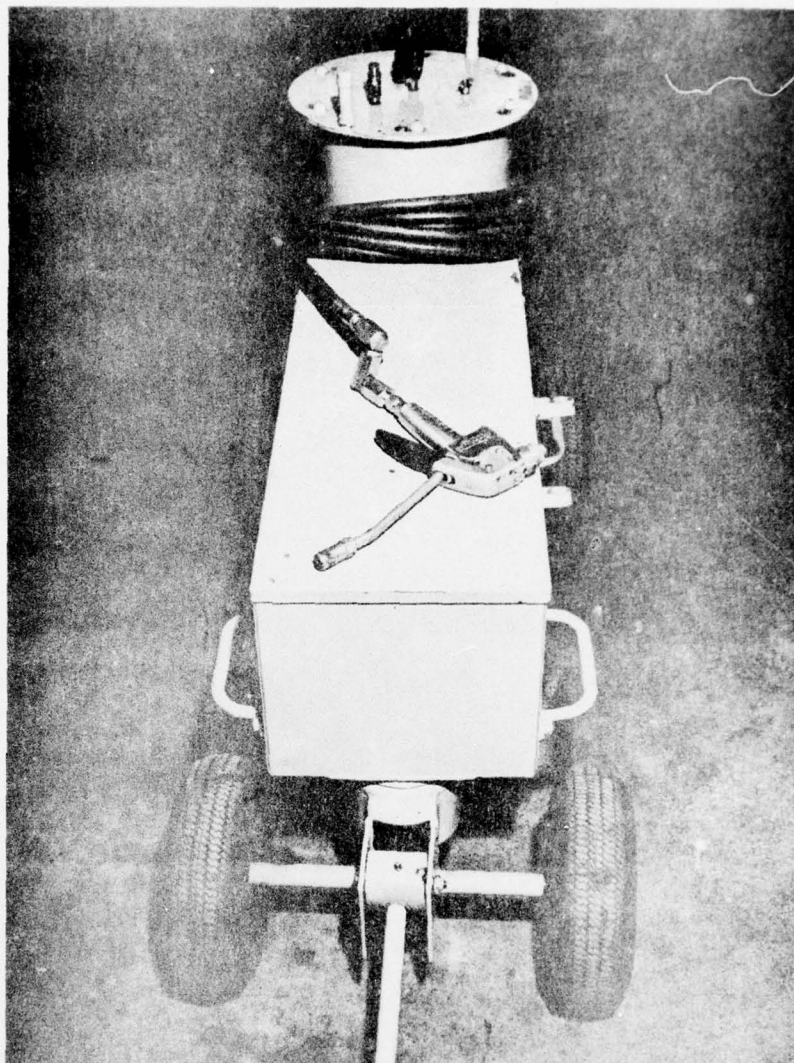


Figure 7. Front view of the currently-authorized unit.

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SECTION 3 - APPENDICES

DEFICIENCIES AND SHORTCOMINGS

A. Deficiency. The following deficiency was discovered during test:

<u>Deficiency</u>	<u>Suggested Corrective Action</u>	<u>Remarks</u>
The minimum pressure on the test item was too high for servicing aircraft components with seals.	Incorporate a nozzle adjustable from 100 p.s.i. to 6000 p.s.i.	The adjustable nozzle would provide a pressure which would not damage seals in sensitive components. This deficiency also exists in the authorized lubricator.

B. Shortcomings. The following shortcomings were discovered during test.

<u>Shortcoming</u>	<u>Suggested Corrective Action</u>	<u>Remarks</u>
1. The test item does not have attachments for sling loading.	Add attachment points for air transportability	This shortcoming also exists in the authorized lubricator.
2. Operational and maintenance publications were not furnished for the test item.	Publications be provided in the standard Army format for operational and maintenance manuals.	
3. The test item was difficult to move over other than hard, flat surfaces.	Increase tire size and ground clearance.	

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<u>Shortcoming</u>	<u>Suggested Corrective Action</u>	<u>Remarks</u>
4. The test item servicing hose was too short.	Extend the hose to a minimum of 30 feet in length.	
5. The test item was restricted to 110 volts a.c. for charging the battery.	Incorporate an auxiliary power receptacle on the test item compatible with APU and vehicular-type power sources.	This shortcoming also exists in the authorized lubricator.

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